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(56) Documents Cited
GB 2231418 A GB 2222899 A EP 0560277 A1
WO 93/08521 A1 WO 93/02419 A1 WO 91/01065 A1
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(54) Computer security device which disables a disc drive

(57) A security device (2) for a personal computer comprises means (6, 8) for insertion in-line between a disc controller (10) and a disc drive (12), and means (14) to disable the disc drive (12).

The security device (2) can be used to prevent boot up from a floppy disc drive whilst allowing access to the floppy disc drive to allow information to be saved on the floppy disc. It includes switches in control lines of one or more disc drives and involves software allowing "drive 1" to be addressed as "drive 0".

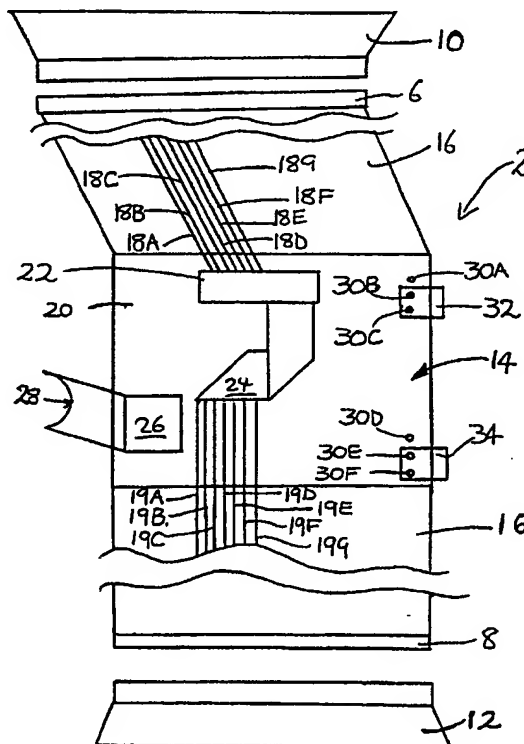


FIGURE 2

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

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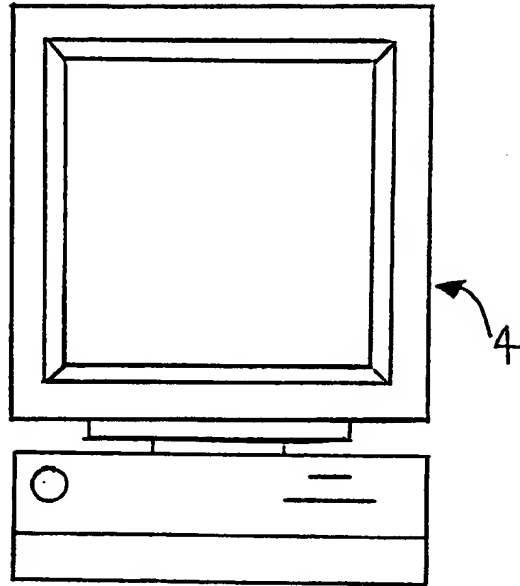


FIGURE 1

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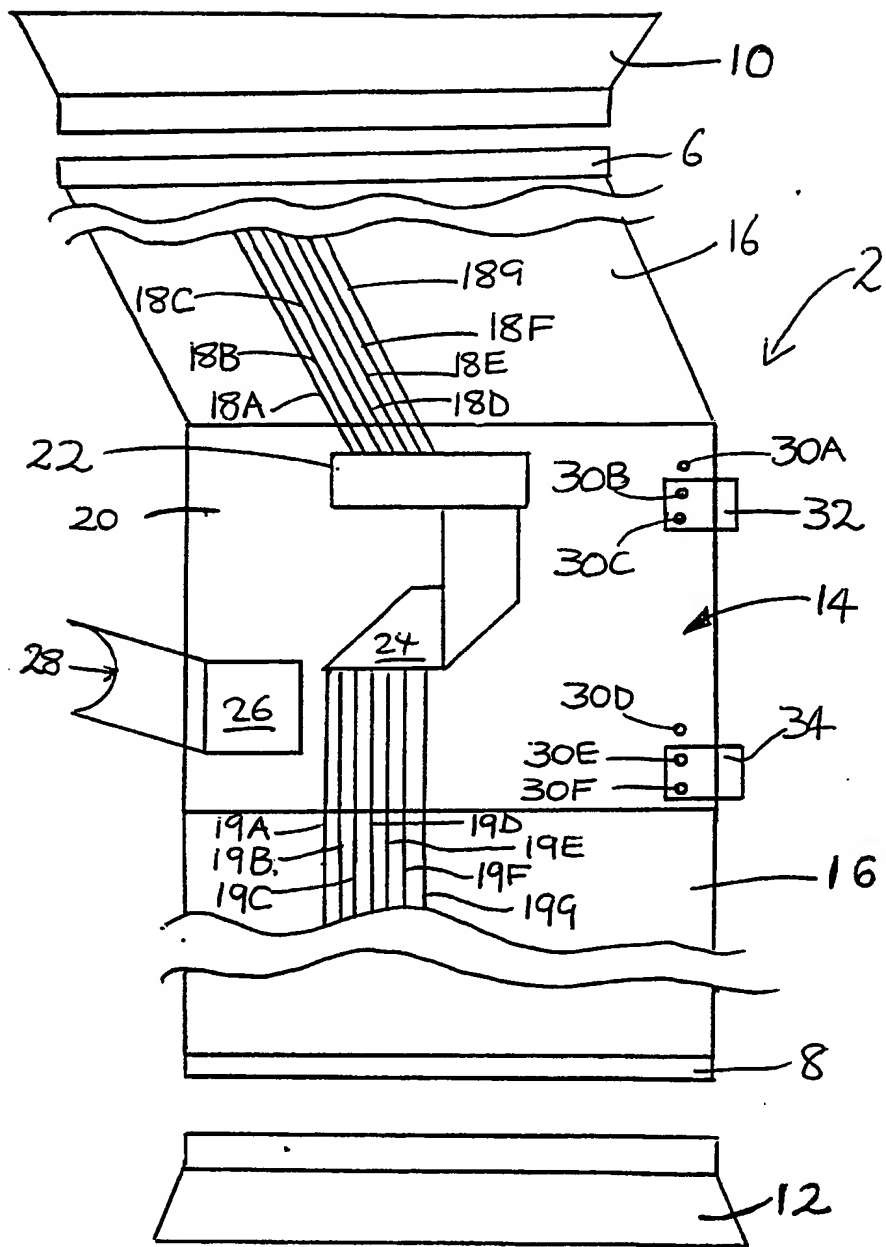


FIGURE 2

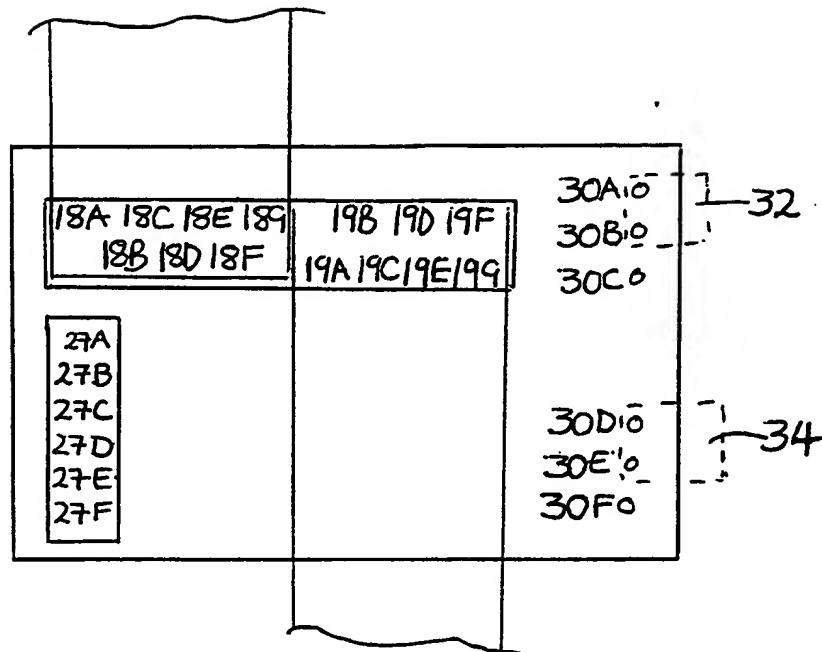


FIGURE 3

SECURITY DEVICE

Field of the Invention

The present invention relates to security devices, especially security devices for IBM compatible (including IBM) personal computers (hereinafter "PC's").

Background to the Invention

Generally, a PC has at least two disc drives from which it can load data/software and/or to which data/software can be saved. The drives generally include a hard disc, usually (though not necessarily) integral with the PC and at least one so-called "floppy" disc drive (usually for 3 1/2 inch discs). In some PC's there is a second floppy disc drive (usually for 5 1/4 inch discs). The hard disc can be used to store software or information that is frequently required for the general use of the PC, while floppy discs can be used for temporary storage of data, for back-up purposes or for less frequently used programs.

In terms of the PC's operation, the disc drives are allocated numbers 0 for the first floppy disc drive, 1 for the second floppy disc drive (which can be addressed as such even if it is not present) and so on up to 127. Numbers equal to or greater than 128 will be treated as the hard disc drive.

When a PC is first switched on, its firmware (hard-wired logic) attempts to load a control program from the first disc that it can find with a suitable program. This in turn loads the operating system that will control the PC.

This procedure is known as a "boot" or "boot up". The firmware first tries drive 0 and, if it receives no suitable program, then tries the hard disc.

In normal circumstances, when no floppy discs are present in the drives, the PC will select the hard disc from which to load its control program. A control program loaded from the hard disc or a subsequently loaded operating system can include various security features to negate or minimize the risk that unauthorised use will be made of the PC in order to, for instance, detect worms or viruses (as they have become known) on to the system or to prevent their being loaded. Many such security products are available, for instance the DiscLock, Immunizer and UltraMenu (all trade marks) products available from VISIONSOFT LIMITED of Unit M4, Enterprise 5, Five Lane Ends, Bradford, BD10 8BW, United Kingdom.

However, because in the boot process the PC firmware first addresses drive 0, before the hard disc, if a floppy disc has been inserted into drive 0 a control program and/or virus can be booted up from there, effectively bypassing any security software on the hard disc. Therefore, a user can, by this technique, gain unauthorised access to the PC and, in certain situations, to networks and cause considerable damage. (Note that a PC will not attempt to boot up from drive 1 before the hard disc).

Also, if the PC is allowed to boot from drive 0, the hard disc inside the PC can potentially be infected by a "boot sector" computer virus if one was present on the floppy disc.

Prior Art Known to the Applicant

The problem set out above has been recognised in the computer industry. The current solution to this problem is to provide a physical lock over the floppy disc drive(s) to prevent unauthorised use. One such product is described in US Patent No 4,640,106

However, such a product has the disadvantage that, once locked it prevents the disc drive(s) from being used at all so that data cannot be saved on to a floppy disc in the

usual way. In most organisations this is intolerable, so it is necessary to have relatively easy access to keys (or other security releasing means) to remove the physical lock. This easy access to keys means that the system is often inherently less secure than desired.

Furthermore, it may be possible for these known devices to be prised away from the floppy drives by exerting sufficient force.

Summary of the Invention

According to the present invention there is provided a security device for a PC, the security device comprising means for insertion in-line between a disc controller and a disc drive and means to disable the disc drive.

Such a security device cannot be seen from the exterior of the PC and is, therefore, advantageous over known devices. Furthermore, its operation is electrical not physical so it provides an enhanced security system. Even if the PC is opened, it can be difficult to locate the security device.

Preferably the disc drive is only disabled during the boot process.

The disc drive can be a hard disc drive, if it is required to prevent access thereto, or a floppy disc drive. In the case of a floppy disc drive, it is preferably the drive 0 so that an unauthorised boot up cannot be carried out but the hard disc drive can be used.

The security device preferably comprises means to switch the disc drive from its disabled to an enabled state in which access to the disc drive is permitted for the boot up process. The switching means preferably comprises a lock means.

The security device preferably comprises means to enable the drive to which access is disabled to be changed to provide maximum flexibility. This flexibility can be provided by jumpers.

The means to disable the disc drive preferably comprises a break in the motor enable drive 0 wire. More preferably the drive 1 can still be used. Most preferably the PC is

also supplied with software so that the drive 1 can be addressed as drive 0. The motor enable drive 0 and drive 1 wires and the select drive 0 and drive 1 wires are the control lines.

In a single floppy disc drive system, the disabling means preferably comprises the breaking of a control line to drive 0 and the rerouting to drive 0 control of lines normally going to drive 1.

In a double floppy disc drive system, the disabling means preferably comprises the breaking of a control line to drive 0 and the maintenance of control lines to drive 1.

Conveniently the security device is located in a cable between the disc controller and the disc drive.

More preferably the security device includes connectors to enable it to be connected to the disc controller and the disc drive.

According to the present invention, there is also provided in a second aspect a PC including a security device as set out above.

Furthermore, according to the present invention there is further provided in the third aspect a kit including a security device as set out above and program storage means which can be used to load software on to the PC to allow the disabled drive to be addressed.

Brief Description of the Drawings

The invention will now be described by way of example only, with reference to the drawings that follow; in which:-

Figure 1 is a schematic illustration of a PC.

Figure 2 is a schematic illustration of a security device according to the present invention.

Figure 3 is a schematic circuit diagram illustrating the mode of operation of the present invention.

Description of the Preferred Embodiments

Figures 2 and 3 show a security device 2 for a PC 4 (Figure 1), the security device 2 comprising means 6, 8 to enable it to be inserted in-line between a disc controller 10 and a disc drive 12 and means 14 to disable

the disc drive 12.

Referring now to Figure 1 there is shown a PC within which is located a security device 2 (Figures 2 and 3). The security device 2 is ready to be inserted between a disc controller 10 and a disc drive 12 (the connections of which are visible in Figure 2). The security device 2 is located in-line in the ribbon cable 16 used to connect the disc controller 10 to the disc drive 12. At one end of the ribbon cable 16 is a disc controller connector 6 and at the other end is a disc drive connector 8.

In a PC the disc controller 10 can be a plug-in card or it can be built into the main processor board of the PC. This controller 10 can either be a dedicated "hard" or "floppy" controller or it can be capable of handling both devices.

In this example, the disc drive 12 is the drive 0 and the disc controller 10 is appropriate for controlling drive 0.

Of the 34 wires in the ribbon cable 16 only seven input wires 18A-18G and seven output wires 19A-19G are shown in Figure 2 and referred to in more detail below.

The security device 2 comprises a printed circuit board (PCB) 20 which is represented schematically in Figure 2 and 3. On the PCB 20 are input means 22 and output means 24 for the wires 18A-18G and 19A-19G respectively. The ways in which the wires 18, 19 are configured are discussed in more detail below.

Also on the PCB 20 is a switching means 26 which itself is connected to a key socket 28 which can be fitted in an open port of the PC. The switching means 26 is a 2 pole, 2 position switch operated by a key (not shown) in key socket 28. The switching means 26 has terminals 27A-27F. In its locked position the switching means 26 connects terminal 27A to terminal 27B and terminal 27D to terminal 27E. The unlocked second position of switching means 26 connects terminal 27A to terminal 27C and terminal 27D to terminal 27F. Also shown on the PCB 20 are terminals 30A-30F over which are connected a first jumper 32 and a second jumper 34.

In Figure 2 it can be seen that the output wires 19A-19G twist away from the device 2 to keep in line with the inputs.

The configuration of the switching means 26 and of the jumpers 32 and 34 determines how the inputs and outputs of wires 18A-18G and 19A-19G respectively are connected together and so the state of the drive 12 as explained below. The seven wires 18A-18G are input wire numbers 10-16 inclusive on the 34 wire cable 16 as set out below in Table 1:

Table 1 - Wire Designations

<u>Figure 2 Reference</u>	<u>Wire Numbers</u> (on 34 Wire Cable)	<u>Wire Designation</u>
18A	10	Motor enable drive 0
18B	11	Ground
18C	12	Select drive 1
18D	13	Ground
18E	14	Select drive 0
18F	15	Ground
18G	16	Motor enable drive 1

The output wires 19A-19G are designated accordingly, ie 19A in the output of the motor enable drive 0 from the PCB 20.

In all cases in the embodiments of the present invention set out herein the ground wires 18B, 18D and 18F, and 19B, 19D and 19F are allowed to pass unhindered through the security device 2. The ground wires 18B, 18D and 18F, and 19B, 19D and 19F are only intercepted in the first place for the convenience of not having to separate off the other wires 18A, 18C, 18E and 18G, and 19A, 19C, 19E and 19G. Therefore, the only inputs to PCB 20 that need to be considered in detail are those of wires 18A, 18C, 18E and 18G. The only outputs of relevance are 19A, 19C, 19E and 19G which are designated accordingly which are, respectively, the motor enable drive 0, select drive 1, select drive 0 and motor enable drive 1 as set out in

Table 1 above.

For a PC having a single floppy disc drive 0 the switching means 26 enables the security device 2 to be in a "locked" or an "unlocked" state. The "locked" state is one in which access to drive 0 for boot up purposes is disabled. The "unlocked" state is one in which access to drive 0 for boot up purposes is enabled.

In the locked state the configuration (location of jumpers 32, 34 and state of switching means 26) of the circuit is such that the connections between the input wires 18A-G and output wires 19A-19G is as follows, with "X" indicating that a line is broken (ie has no output).

Table 2 - Single drive locked

<u>Input</u>	<u>Output</u>
18A - motor enable drive 0	X
18C - select drive 1	19E - select drive 0
18E - select drive 0	19E - select drive 0
18G - motor enable drive 1	19A - motor enable drive 0

In the single drive's unlocked configuration the connections between the input wires 18A-18G and output wires 19A-19G are as follows:

Table 3 - Single drive unlocked

<u>Input</u>	<u>Output</u>
18A - motor enable drive 0	19A - motor enable drive 0
18C - select drive 1	19E - select drive 0
18E - select drive 0	19E - select drive 0
18G - motor enable drive 1	X

In the locked configuration of Table 2 drive 0 is disabled because the wire 18A (motor enable drive 0) is broken. Thus, when the PC 4 is switched on it will attempt to select and enable drive 0, receive no response because the wire 18A (motor enable drive 0) is broken and so boot

up from the hard disc regardless of whether a disc is present in drive 0.

In addition, the wires 18A-18G and 19A-10G are so configured that if drive 1 is addressed (note that there is no physical drive 1 in this system), the signal is routed to drive 0. Thus, in order to use drive 0 for purposes other than booting up, the user merely needs to address drive 1 using the usual notation. Note that the PC system architecture is such that although a single floppy disc drive system only has a physical drive 0, it can still handle signals to drive 1 without automatic errors because the relevant wiring is still present.

In order to simplify this procedure, software is provided with the security device so that once the boot up has been carried out and the software loaded, reference to drive 0 will automatically use the enable and select signals for drive 1 (which are subsequently rerouted to drive 0 by the security device 2). Software to achieve this can easily be produced by a person skilled in the art for any of the available operating systems currently available on PC's (eg Unix, Xenix, OS2, DRDOS or Novell). In the MSDOS operating system of PC 4 of the present example the internal table instructing the PC 4 which physical drive relates to which letter (A or B) when entered by a user, is amended. The effect at the amendment is that when a user enters "A:" (which the PC normally relates to drive 0) the PC relates this to drive 1. The command "B:" is also related to drive 1.

The software referred to above can also include a standard user/password system to govern usage of the PC.

The overall effect of this system is that a user cannot boot up the PC from drive 0. The PC will automatically boot from the hard disc thus enabling any security software to be loaded as desired and not bypassed. However, after boot up, the user can make use of the PC 4 in the usual way since references to drive 0 will, because of the software referred to above, operate drive 0 even though the control lines to drive 0 are interrupted.

In the single drive unlocked configuration (Table 3) inputs 18A (motor enable drive 0) and 18E (select drive 0) are output to their normal outputs 19A and 19E respectively so the floppy disc drive works exactly as normal.

The case of a twin floppy disc drive system is more complex because the system has a physical drive 1.

For a two drive system the locked and unlocked configurations are as follows:

Table 4 - Twin Drive Locked

<u>Input</u>	<u>Output</u>
18A - motor enable drive 0	X
18C - select drive 1	19C - select drive 1
18E - select drive 0	19E - select drive 0
18G - motor enable drive 1	19G - motor enable drive 1

Table 5 - Twin Drive Unlocked

<u>Input</u>	<u>Output</u>
18A - motor enable drive 0	19A - motor enable drive 0
18C - select drive 1	19C - select drive 1
18E - select drive 0	19E - select drive 0
18G - motor enable drive 1	19G - motor enable drive 1

As for the single disc drive in its locked configuration (Table 2 above), this twin drive configuration disables access to the drive 0 by breaking the line 18A motor enable drive 0. However, drive 1 is operational in the usual way (the control lines 18C/19C - select drive 1 - and 18G/19G. - motor enable drive 1 are neither broken nor diverted). Therefore, when the PC 4 is first switched on it asserts drive 0, receives no response and boots from the hard disc. Subsequently, drive 0 remains locked, but drive 1 can be used as normal. A label on the PC, or a screen signal can be used to alert the user to the fact that they need to

insert their discs into drive 1 (what they will recognise as drive B) and address that drive.

In the twin drive unlocked state (Table 5 above), all of the wires 18A-18G and 19A-19G remain connected as normal thus allowing full access to the twin drives.

It is also possible to disable all of the floppy disc drives when locked using the following input/output configuration.

Table 6 - All Locked

<u>Input</u>	<u>Output</u>
18A - motor enable drive 0	X
18C - select drive 1	19E - select drive 0
18E - select drive 0	19E - select drive 0
18G - motor enable drive 1	X

Thus the motor enable wires 18A and 18G. for drive 0 and drive 1 are broken so neither drive can be used. This effectively bars the floppy disc drives from use.

The unlocked configuration is as follows:

Table 7 - All Unlocked

<u>Input</u>	<u>Output</u>
18A - motor enable drive 0	18A-motor enable drive 0
18C - select drive 1	18E - select drive 0
18E - select drive 0	18E - select drive 0
18G - motor enable drive 1	X

Because line 18G (motor enable drive 1) is broken in both the all locked (Table 6) and all unlocked (Table 7) configurations, drive 1 will not work even when "unlocked". Only drive 0 is available. This limitation has been accepted to keep components to a minimum in this embodiment of the present invention, but ideally the configuration would be as shown in Table 5.

Referring to Figure 3, the connections of the PCB 20 are shown schematically. As mentioned above, the six states of

the security device (single drive locked, single drive unlocked, double drive locked, double drive unlocked, all drives locked and all drives unlocked) are determined by the positions of the jumpers 32, 34 on the terminals 30A-30F and of the switching means 26 in relation to terminals 27A-27F. The jumpers 32, 34 determine whether the state of the device 2 is set for a single drive, a double drive or both drives disabled. The switching means 26 enables the system to be changed between its locked and unlocked states, thereby giving the user maximum flexibility in enabling or disabling use of drive 0 for boot up.

The hard wiring of the PCB 20 is as follows:

18A - 27A
 18B - 19B
 18C - 30B
 18D - 19D
 18E - 19E
 18F - 19F
 18G - 30E
 19A - 27E
 19C - 30C
 19E - 30A
 19G - 30F
 27D - 30D
 27C - 27E

The configurations of the security device for the five states referred to above are as set out in Table 8 below.

Table 8 - Configurations

<u>Jumper 32</u>	<u>Jumper 34</u>	<u>Switch Position</u>	<u>State</u>
30A/30B	30D/30E	27A-27B/27D-27E	Single Drive Locked
30A/30B	30D/30E	27A-27C/27D-27F	Single Drive Unlocked
30B/30C	30E/30F	27A-27B/27D-27E	Double Drive Locked
30B/30C	30E/30F	27A-27C/27D-27F	Double Drive Unlocked

12.

30A/30B	Removed	27A-27B/27D-27E	All locked
30A/30B	Removed	27A-27C/27D-27F	Unlocked

It will be clear to a person skilled in the art that the present invention can be used to prevent the use of a hard disc drive as well as that of a floppy disc drive.

CLAIMS

- 1 A security device for a PC, the security device comprising means for insertion in-line between a disc controller and a disc drive and means to disable the disc drive.
- 5 2 A security device according to claim 1, in which the disc drive is disabled only during the boot process.
- 3 A security device according to claim 1 or 2, in which the disc drive is a hard disc drive.
- 4 A security device according to claim 1 or 2, in which
10 the disc drive is a floppy disc drive.
- 5 A security device according to claim 4, in which the disc drive is the drive 0 so that an unauthorised boot up cannot be carried out but the hard disc drive can be used.
- 6 A security device according to any one of the preceding
15 claims, also comprising means to switch the disc drive from its disable to an enabled state in which access to the disc drive is permitted for the boot up process.
- 7 A security device according to claim 6, in which the switching means comprises a lock means.
- 20 8 A security device according to any one of the preceding claims, also comprising means to enable the drive to which access is disabled to be changed to provide maximum flexibility.
- 9 A security device according to any one of the preceding
25 claims, in which the means to disable the disc drive comprises a break in the motor enable drive 0 wire.
- 10 A security device according to claim 8, in which the drive 1 can still be used when the disc drive is disabled.
- 11 A security device according to any one of the preceding
30 claims, in which the PC is supplied with software so that the drive 1 can be addressed as drive 0.
- 12 A security device according to any one of the preceding claims, in which the security device is located in a cable

between the disc controller and the disc drive.

13 A security device according to claim 12, which includes connectors to enable it to be connected to the disc controller and the disc drive.

5 14 A security device according to any one of the preceding claims for use in a single floppy disc drive system, in which, the disabling means preferably comprises the breaking of a control line to drive 0 and the rerouting to drive 0 control of lines normally going to drive 1.

10 15 A security device according to any one of claims 1 to 14 for use in a double floppy disc drive system, in which, the disabling means preferably comprises the breaking of a control line to drive 0 and the maintenance of control lines to drive 1.

15 16 A PC including a security device according to any one of the preceding claims.

17 A kit including a security device according to any one of claims 1 to 15 and program storage means which can be used to load software on to the PC to allow the disabled
20 drive to be addressed.

18 A security device for a PC arranged substantially as herein described, with reference to, and as illustrated in Figures 2 and 3 of the accompanying drawings.

19 A PC arranged substantially as herein described, with
25 reference to, and as illustrated in Figures 1 to 3 of the accompanying drawings.

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Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
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Relevant Technical Fields

(i) UK Cl (Ed.M) G4A (AAP); G5R (RB882, RB883, RB884, RB885)

(ii) Int Cl (Ed.5) G06F (1/00, 12/14)

Search Examiner
B G WESTERN

Date of completion of Search
28 JULY 1994

Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASE: WPI

Documents considered relevant following a search in respect of Claims :-
1-19

Categories of documents

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E,X	EP 0560277 A1	(SHAO) NB Figure 1, columns 5, 6	1-3,12,13,16
X	WO 93/08521 A1	(WYNTER et al) see whole document	1,2,4,5,10,12,13,16,17
X	WO 93/02419 A1	(J A S TECHNOLOGY) see pages 1-37, Figures 1-3	1,2,3,10,12,13,16,17
X	WO 91/01065 A1	(MARTIN MARIETTA) see whole document	1-8,10,12,13,16,17
X	WO 90/00771 A1	(VERWEYEN) see whole document	1,3-5,12,13,16
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